

String Scale Cosmological Constant

Gordon Chalmers

e-mail: gordon_as_number@yahoo.com

Abstract

The cosmological constant is an unexplained until now phenomena of nature that requires an explanation through string effects. The apparent discrepancy between theory and experiment is enourmous and has already been explained several times by the author including mechanisms. In this work the string theory theory of abolished string modes is documented and given perturbatively to all loop orders. The holographic underpinning is also exposed. The matching with the data of the LIGO and D0 experiments is also explained to the first three or more moments in the cosmological expansion.

There are three explanations of the cosmological data incorporating the energy density, the cold dark matter, galactic curve data and galactic halo effect. The information is encoded in the expansion moment by moment in the expansion of the cosmological constant density functional. In three prior works a sugra, field theory, and string theory explanation have been given [1],[2]. These three contexts are finally unified in the setting of $\mathcal{N} = 2$ sugra and its broken forms in the context of string bits which are in fact holographied string fragments. These string bits have never been fully analyzed in the literature except in the context of holographic forms and apply in [1].

The expansion of the exact constant goes like

$$V(\Lambda, M) = \sum \Lambda^4 (\Lambda/M^2)^n \quad (1)$$

with the first term the discrepancy between the experiment and theory. It is commonly assumed that the first two terms dont match and as told in [1]

$$\frac{\Lambda^8}{M^4}, \quad (2)$$

is the measured cosmological energy density to a large factor consisting up to nine digits. This assumes supersymmetry breaking of 3 TeV. The second term namely

$$\frac{\Lambda^6}{M^2}, \quad (3)$$

also does not match with the current experimental data being off by an order of 50 digits and indeed is expected to conform to data. It is explained that not only is this term the leading correction to the cosmological data from theory. Both the first Λ^4 and Λ^6 will be explained in addition to the entire series. The first two terms are absent. The first term absence can be explained by a holographic dimensional analysis and the second term by a holographic correspondence with the dimensional parameter called the fine structure of matter controlled vacuum. The third moment and its higher order terms generate the cosmological expansion with cold dark matter. The holography is further explained.

The cosmological constant measures the energy expansion of the universe at various stages including the before mentioned effects. It is difficult to resolve in the prior ages due to the absence of a controled expansion. One is given here. Consider string

bits which are fragments of a string broken into successive halves and quarters never ending. In actual fact there is an experimentally determined minimum length. They wiggle about and actually teleport from one location to the next. They also match holographically transpose with higher dimensional modes. Take the Λ^6/M^2 term and sum there masses through the formula

$$\Lambda^4 m^2/M^2 = \sum_{n=0}^{\infty} \Lambda^4 m^2/M^2 e^{-M/\Lambda^4 \alpha n} = \Lambda^4 m^2 \Lambda^4/M^4 \alpha^{-1} \quad (4)$$

and agrees with Λ^6/M^2 when $\alpha = \Lambda^2/M^2$ which is called the ambient energy density of spacetime without the string bits. Furthermore there are an infinite number of power order corrections.

The real constant can now be obtained from the following set $\frac{m_0}{\alpha}$ equal to a prefactor which agrees with the hubble experiment with Λ the supersymmetry breaking scale of an approximate 2 TeV. The string scale is m_0 and that leads to the ratio of about nine digits. The next term is Λ suppressed and generates part of the dark matter which is cold for the simple reason that they are string bits.

Consider $\mathcal{N} = 2$ there is a D-term flatness condition that brings about a term which is Λ^6/M^2 and indeed after summing the entire series of the string bits of the gravitational multiplet generate the observed value of the cosmological constant. This is with the fine structure constant of matter controlled vacuum. The loop effects have a vertices containing four derivatives with the exception of several modes. The string coupling of a massive mode to a massless mode such as the dilatino has four derivatives and

$$\frac{1}{M^2} \int \frac{k_\alpha k_\beta k_\mu k_\nu}{(k^2 - m^2)} , \quad (5)$$

has four derivatives in one gauge and two in the other. The gauge fixing is determined to manifest the coupling dependence and the mass is $m_0 e^{n\Lambda^4/M^4 \alpha}$. The net result of the integral modewise for the entire series of the string bits is controlled by α' by the expansion previously given with the Λ^4 term missing. As explained in previous work [1] the rest of the higher loop terms are suppressed by successive orders Λ^2/M^2 . The regulator is important to determine the supersymmetry broken value of the prefactors.

The graviton propagator in de Donder gauge has only two derivatives and that of the fermionic gravitino has only one and they cancel in softly broken supergravity. In our case we have a graviton which is massive by only a tidbit and whose mass is given

by a bound state of the massless mode in the langrangian together with the hopping of the string tidbit from one mode to the other. . This results in the bound state of the graviton between one particle and another with the string tidbit generating the mass in the range of 2 TeV. This is observed in the bifurcation of the galactic halo of mercury around the sun in the precession due to the bending of light. Also it occurs as observed in the holographic lensing of light around various supernovae including mercury b and supernova a. The mass shouldnt be shocking because the matter of gravity hasnt been measured in the MeV range. There are claims to the mass of gravity being zero but this isnt clear as there data precludes the precession of motion of mercury around the sun in orbital fashion and the two degrees of arc motion that general r predicts is wrong. There are another four hundred arcseconds unaccounted for by the holographic lensing of matter against light. This matter is unaccounted for but could be made manifest possibly with a four derivative term which at low energy really obfuscates the mass. The mass can be determined from that. It is actually holographic and this is made clear later.

The entire series

$$g = \sum \Lambda^4 (\Lambda/M^2)^n , \quad (6)$$

sums up to the perturbative contribution. The holographic contribution is written as a double sum with wedges

$$V(\Lambda, M, \alpha) = f(\Lambda, M, \alpha) \wedge g(\Lambda, M, \alpha) \wedge h(\Lambda, M, \alpha) , \quad (7)$$

which represents multiplication coadjoint like from term to term such as the middle representing the perturbative the outer left the holographic and the inner right the twist between the two. It is expected the outer right to be a sixth of the inner left due to the conformal group. In other words holography to quantize the form of f to be $f^{1/n\alpha}$. The isometry group of $SO(6)$ of the five sphere is expected to play a role as in the holographic duality in $\mathcal{N} = 4$ and generates a quantization condition in the realistic proposed holography¹. The outer left is expected to be quantized also. The two numbers $f^{1/n\alpha}$ and $g^{1/m\alpha}$ could be related to the group of $SO(6)$ with $n = 10$ and the group D_6 with twelve generators which twists the action with an endomorphism on the spacetime. The latter is preferred for the holographic conjecture and is related to the global structure of spacetime.

¹In media res work not printable yet.

The cosmological constant has been explained in view of string bits and the holographic contribution clarified. The holographic extension will be exposed in future work on gravity and string theory once finished. It is expected to be very accurate to the point of testability in the current experiment of LIGO. Three to six moments are expected to be measurable.

The spectrum of string bits at finite temperature is expected to follow from the generating function

$$p(n)e^{-k_bTE(n)} , \tag{8}$$

with $p(n)$ the mode number. Each particle and string indeed which also fit the expansion gives breaks into a tower of bits. There is a possible exception with the tachyon which is not discussed. The probability distribution can be further used at finite temperature to mildly put a restriction on the entire series of f , g , and maybe h .

To conclude the data of D0 as described in [3] can be used to further find the gravitational lensing of the gravitino which is claimed to be there and its interaction with matter. The time spacing between the zbg's could show how the cosmological constant appears in their experiment. Two or three measurements of the moments are expected.

References

- [1] G. Chalmers, “Cosmological constant in broken maximal sugras,” *Class. Quant. Grav.* **19**, L193 (2002) [arXiv:hep-th/0103225].
- [2] G. Chalmers, “Realistic cosmological constant,” arXiv:physics/0510269.
- [3] G. Chalmers, “Supersymmetry and B/s, D0, and Aleph i,” arXiv:physics/0605114.